

License No. 29-21348-01

Docket No. 030-20550

AMENDMENT REQUEST

Please amend our present NRC License No. 29-21348-01 in its entirety, to include a change of named licensee, corporate address, and the following additional possession and use of licensed material.

Change of Named Licensee and Address:

- o Delete: The present named licensee and address.
- o Add: 1. Westinghouse Electric Corporation
Radiological Services Division
New Jersey Operations

2. 1256 North Church Street
Moorestown, New Jersey 08057

(1) Location of Use:

Maintenance facility located on Evesboro-Medford Road in Medford, New Jersey, and at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.

8707210207 870330
REG1 LIC30
29-21348-01 PDR

ML10
"OFFICIAL RECORD COPY"

106780

RLGa-10-01

Material To Be Possessed:

<u>Element and Mass Number</u>	<u>Chemical and/or Physical Form</u>	<u>Maximum Activity To Be Possessed At this Location</u>
A. As specific in Section 33.100, Schedule A of 10 CFR 33	ANY	As specified in Section 33.11(b) of 10 CFR 33 (Type B Broad License), not more than 1 curie total as contamination
B. Any byproduct source, or special nuclear material between Atomic Nos. 84 and 98 inclusive	ANY	No more than 1 curie total as contamination which includes no more than 100 milligrams special nuclear material

Purpose(s) For Which Licensed Material Will Be Used:

- o The principle use of licensed material at this location would be the possession, storage, and refurbishing of contaminated equipment and

systems such as shipping casks, rad-waste processing equipment, and other mobile systems used to provide a variety of services to nuclear power industry and other plants.

- o Possession of sources used for calibration and/or reference and other uses of licensed material as specified in 10CFR 33.14(b) (2).

(2) Location of Use:

- o Licensed material will be possessed and used at the instrument repair and calibration facility located in the Westinghouse Radiological Services Division (WRSD) corporate offices at 1256 North Church Street, Moorestown, NJ 08057. This location is in addition to our currently authorized places of use.
- o Licensed material may also be used at temporary job sites of the licensee anywhere in the United States where the Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.

Material To Be Possessed:

<u>Element and</u>	<u>Chemical and/or</u>	<u>Maximum</u>	<u>Activity</u>
<u>Mass Number</u>	<u>Physical Form</u>	<u>Per Source</u>	
1. Cesium-137	Sealed Source	Not to exceed	
	Amersham Corporation	130 millicuries/	
	Model X.8 or X.9	source	

<u>Element and</u> <u>Mass Number</u>	<u>Chemical and/or</u> <u>Physical Form</u>	<u>Maximum</u> <u>Activity</u> <u>Per Source</u>
2. Cesium-137	Sealed Source Amersham Corporation Model X.8 or X.9; Gamma Ind. Model VD (HP); Isotope Products Model 193; Industrial Reactor Lab Models 2-4 or 2-10; J.L. Shepherd Model 6810; 3M Co. Models 4P6E, 4F6H, 4D6L or 4F6S; or U.S. Nuclear Model 375	Not to exceed 3 curies/source
3. Cesium-137	Sealed Source J.L. Shepherd Model 6810 or Gamma Ind. Model VD (HP)	Not to exceed 400 curies/ source
4. Any byproduct material with atomic numbers 1-83, inclusive	Any sealed or solid source commercially available	Not to exceed 100 millicuries/ source and a total of 1 curie

<u>Element and</u>	<u>Chemical and/or</u>	<u>Maximum</u> <u>Activity</u>
<u>Mass Number</u>	<u>Physical Form</u>	<u>Per Source</u>
5. Plutonium-239	Solid Source Eberline Corporation Model S94-1 source set	5uCi/Set
6. Cesium-137	Sealed Source Amersham Model X.38	2.4 Curies/ source

Purpose For Which Licensed Material Will be Used:

1. To be used for low-range (0.2 - 20 mR/hr) calibration of radiation survey and monitoring devices in a J.L. Shepherd Model 81-12 Beam Irradiator, with Built-In Model 155 Attenuator System.
2. To be used for medium-range (1-500 mR/hr) calibration of radiation survey and monitoring devices a J.L. Shepherd, Model 28 - 6A Beam Irradiator.
3. To be used for the medium (1-500 mR/hr) and high range (> 1R/hr) calibration of radiation survey and monitoring devices in a J.L. Shepherd Model 81-12 Beam Irradiator, with a Buill-In Model 155 Attenuator System.
4. To be used as reference and calibration sources for radiation detection instruments and the evaluation of leak test samples.

5. To be used as reference and calibration sources for radiation detection instruments and the evaluation of leak test samples.
6. To be used in a WILLISTON ELIN (WE 2001) closed TLD irradiator.

NOTE: ALL STANDARD SOURCES TO BE USED FOR THE CALIBRATION OF SURVEY AND MONITORING INSTRUMENTS, POCKET DOSIMETERS, AND PERFORMING ANALYTIC MEASUREMENTS ON LEAK TEST SAMPLES SHALL BE TRACEABLE TO NBS AND HAVE AN ACCURACY OF AT LEAST $\pm 5\%$ OF THE STATED VALUE.

Training Programs

1. The training and experience of each individual designated as an Authorized User for the Calibration Facility shall be reviewed and approved by the Radiation Safety Officer.
2. Individuals who will perform calibration and work under the supervision of an Authorized User in a restricted area will receive formal training and a written examination on the topics outlined in Attachment 1 under the guidance of the RSO. The formal training and examination shall be documented.
3. On-the-job training for Authorized Users and technicians shall consist of hands-on experience on the operation of the calibration sources and

equipment and/or the calibration of various types of monitoring and measuring instruments in accordance with WRSD Instrument Calibration Procedures. This training shall be documented. Additional training should consist of the use of the instrument manufacturer's current service manuals, instruction sheets and new information on servicing and calibration procedures. This training shall not be documented. The Operating Manuals for J.L. Shepherd Calibration Equipment is provided in Attachment 2.

4. Frequenters to restricted areas will either be escorted by qualified personnel and/or receive training commensurate with the radiological health hazards present.

Facilities and Equipment:

- o An anoted drawing of the calibration facility is enclosed as Attachment 3. The structural shielding design is based on the calculations and assumptions in NCRP-49 for an average weekly exposure not to exceed 0.01 rem in unrestricted areas adjacent to the calibration facility. A documented radiation protection survey shall be performed on completion of construction to confirm that the installation is in compliance with the applicable NCRP recommendations and pertinent NRC regulations.

Radiation Safety Programs:

- o Attachment 4 is the Revised WRSD Radiation Protection Manual. This manual

prescribes the personnel monitoring equipment, waste management, leak testing, bioassays, areas surveys, posting of areas and emergency procedures, etc.

Radiation Detection Instruments:

See Attachment 5.

Calibration of Survey and Monitoring Instruments:

- o Calibrations of survey meters are performed with radionuclide sources. (Neither electronic calibrations that do not involve a source of radiation nor the use of small check sources such as those incorporated into some survey meters are acceptable for calibration.)
- o The sources are approximate point sources.
- o The activity of the source or exposure rates at given distances shall be traceable by documented measurements to a standard source certified within $\pm 5\%$ accuracy by the U.S. National Bureau of Standards (NBS) or other recognized standards laboratory.
- o Instruments should be calibrated at least annually and after servicing.
- o Each scale of an instrument is calibrated on at least two points located at approximately $1/3$ and $2/3$ of full scale. For logarithmic rate-changing

instruments, the calibration is made near the mid-range of each decade, and two points are calibrated on at least one of the decades.

- o The exposure rate measured by the instrument being calibrated shall differ from the true exposure rate by less than $\pm 10\%$ at the calibration points. (Read the appropriate instrument manual to determine how to make the necessary adjustments to bring the instrument into calibration.) Readings within $\pm 20\%$ will be considered acceptable if a calibration chart, graph, or response factor is prepared and used with the instrument to interpret meter readings to within $\pm 10\%$ for radiation protection purposes.

NOTE: A SAMPLE CALIBRATION CERTIFICATE IS IN ATTACHMENT 6

Calibration of Pocket Dosimeters:

DRIFT TEST

1. Zero dosimeter
2. Place dosimeter in a low background location for 24 hours or more. Record time, date and reading at the start of the test.
3. After 24 hours or more, remove dosimeters from storage location and read it. Record the reading.
4. Calculate net Drift as:
$$\text{Net Drift} = \text{Stop Reading} - \text{Start Reading}$$
5. Calculate Total Hours
6. Calculate Drift Rate as $24 \times \text{Net Drift} / \text{Total Hours}$.

7. Calculate % of Full Scale as $\text{Drift Rate} \times 100 \% / \text{Full Scale Dose}$
8. The acceptable limit for drift is 2% full scale.

CALIBRATION

1. Zero dosimeters in accordance with manufacturer's instructions.
2. Place dosimeters on dosimeter jig.
3. Dose dosimeters to a value that is approximately 75% of full scale.
4. Record dose rates, exposure duration and total dose delivered.
5. Remove dosimeters from jig and record them and record reading.
6. Calculate the percent of total dose and the percent error.
7. Error limit is $\pm 10\%$.
8. If dosimeter fails either test do not prepare a calibration certificate. Instead, report these by letter.

NOTE: A SAMPLE CALIBRATION CERTIFICATE IS IN ATTACHMENT 6

Commercial Leak Test Kits:

The following STANDARD SOURCES will be available to calibrate the NMC-PC55 gas flow proportional counter or equivalent to perform measurements of leak test samples.

Co-60	Am-241
Cs-137	Th-230
Pu-239	Tc-99
Sr-90	

The Tracor 1705A (well counter) or equivalent will be calibrated with a cotton swab sealed in a test tube. The following sources are currently available for use.

Co-60	6 nCi
Cs-137	5 nCi

An example of a calculation for converting the leak-test sample counting results is shown below.

DETERMINING DETECTOR EFFICIENCY AND ACTIVITY OF UNKNOWN

STEP 1. CALCULATE EFFICIENCY

$$\text{Eff} = \frac{\text{CPM(STD)} - \text{BKG}}{\text{DPM(STD)}} \times 100\%$$

Where: BKG = Background Counts in Counts Per Minute

CPM(STD) = Counts Per Minute of Standard

DPM(STD) = Disintegrations Per Minute of Standard

[Note: $\text{DPM(STD)} = (\text{Microcuries (STD)} \times (2.22 \times 10^6))$]

Example: BKG = 100 CPM

CPM(STD) = 2000 CPM

STD = 0.005 uCi

$(0.005 \text{ uCi}) \times (2.22 \times 10^6 \text{ DPM/uCi}) = 11,000 \text{ DPM}$

Therefore,

$$\text{Eff} = \frac{2000 - 100}{11000} \times 100\%$$

$$\text{Eff} = \frac{1900}{11000} \times 100$$

$$\text{Eff} = 17.3\%$$

STEP 2. DETERMINE ACTIVITY OF UNKNOWN

$$\text{DPM}(x) = \frac{\text{CPM}(x) - \text{BKG}}{\text{Eff}}$$

Note: Eff in this case is in decimal form
(i.e., 17.3% = 0.173)

Example: CPM(x) = 1000 CPM
BKG = 100 CPM
Eff = 17.3%

$$\frac{1000 \text{ CPM} - 100 \text{ CPM}}{0.173} = 5202 \text{ DPM}(x)$$

$$\text{uCi}(x) = \frac{\text{DPM}(x)}{2.22 \times 10^6}$$

$$\text{uCi}(x) = \frac{5202 \text{ DPM}(x)}{2.22 \times 10^6} = 0.002 \text{ uCi}$$

$$\text{Unknown Sample} = 0.002 \text{ uCi}$$

WRSD Leak Test Kit:

- o A sample of the Hydro Nuclear Services Inc. Leak-Test Kit is enclosed with the license amendment request. This kit is currently the only one we intend to manufacture and distribute at this time; however, it is not intended that WRSD be precluded from modifying or developing other test kits as the market changes.

NOTE: A SAMPLE LEAK-TEST CERTIFICATE IS IN ATTACHMENT 6

ATTACHMENT 1

TRAINING PROGRAM

ATTACHMENT 1

TRAINING PROGRAM

Each technician shall be trained in an in-house program under the guidance of the Radiation Safety Officer. This program will be conducted in a combination lecture and on-the-job training. At the completion of this training, the technician will be examined orally and with a written examination. A passing grade will constitute 80% correct answers. Any technician who has prior training and experience may have the training requirement waived by the Radiation Safety Officer. However, the technician will still be trained in company policy and procedures.

Training will cover the following minimum topics:

I. FUNDAMENTALS OF RADIATION SAFETY

- A. Characteristics of radiation
- B. Units of radiation dose (Rem) and quantity of radioactivity (Curie)
- C. Significance of radiation dose
 - 1. Radiation protection standards
 - 2. Biological effects of radiation dose
- D. Mathematics and calculations basic to the use and measurements of radioactivity

E. Methods of controlling radiation dose

1. Working time
2. Working distance
3. Shielding

II. RADIATION DETECTION INSTRUMENTATION TO BE USED

A. Use of radiation survey instruments

1. Operation
2. Calibration
3. Limitations

B. Survey techniques

C. Use of personnel monitoring equipment

1. Film badges
2. Thermoluminescent dosimeters (TLD)
3. Pocket dosimeters

III. THE REQUIREMENTS OF PERTINENT FEDERAL AND STATE REGULATIONS

IV. THE LICENSEE'S OR REGISTRANTS WRITTEN OPERATING AND EMERGENCY PROCEDURES

V. WRSD QUALITY ASSURANCE MANUAL

VI. CALIBRATOR EQUIPMENT TO BE USED

- A. Operating and maintenance procedures
- B. Characteristics of devices
- C. Control and interlock systems
- D. Attenuators
- E. Source construction and radiation characteristics

VII. EQUIPMENT DECONTAMINATION

- A. Decon procedures
- B. Waste handling
- C. Use of anti-contamination clothing
- D. Use of respirators
- E. Smear/wipe test collection and analysis

ATTACHMENT 2

OPERATING MANUALS

OPERATING MANUAL FOR SERIES 28 CALIBRATION FACILITIES

Model _____

S.N. _____

NOTICE: IF AT ANY TIME THIS CALIBRATOR MALFUNCTIONS, REMOVE THE UNIT FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD AND ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

RADIATION SAFETY

1. The calibrator emits an intense beam or radiation in the area subtended by the beam port (cone). A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. THE OPERATOR SHOULD NEVER STAND IN THE DIRECT BEAM WHILE OPERATING THE UNIT. The operator should also avoid standing in the penumbra adjacent to the primary beam. The unit must be operated at all times from a position behind the calibrator on the side opposite the beam port. The user should set up exclusion lines for personnel using this calibrator as well as limited room access. This information is ordinarily included as part of the facility operation regulations and is required as part of the user's license to possess the calibrator.
2. At intervals not exceeding six months, leak tests should be made on the calibrator by taking wipes at the nearest accessible surface of the source when it is in the "OFF" position. This surface would be at the top of the calibrator where the operating rod extends through the top plate. These wipes should be measured on an instrument capable of measuring 0.005 uCi of Cobalt-60 or Cesium-137, dependant upon which isotope is used in the calibrator. Use of the calibrator should be stopped immediately if contamination is detected and the manufacturer should be notified. NOTE: The 0.005 uc level is that generally prescribed by regulatory authorities: individual institutions may require more stringent standards.

INSTALLATION

Series 28 Calibrators are normally shipped in two parts: (a) The source shield and (b) The stand. To install: Bolt the source shield to stand in the location where calibrator is to be used. Plug cord into a 115 volt (single phase) socket.

OPERATION

1. Remove the padlock which locks the source in the "OFF" position during shipment using the key provided. NOTE: This padlock may be used to lock the source in the "OFF" position at any time that the calibrator is not being used.
2. To expose the source, grasp the black operating knob (while standing behind calibrator, opposite beam port) and raise it until the spring loaded detent engages the depression on the operating shaft. The source is now exposed.
3. To return the source to the "OFF" position, push the operating knob down until the pin on the shaft strikes the stop on calibrator top. The source is now fully shielded.

SAFETY FEATURES

The shield provides for full shielding in all directions at all times except out the beam port when the source is in the "ON" position.

Position indicating lights (green = OFF, red = ON) at the top of the calibrator, show source position at all times. The "ON" light is activated whenever the source is not fully "OFF".

EMERGENCY PROCEDURES

If, at any time, the operation of the source rod becomes difficult, the calibrator should be removed from service. It should be taken to a hot cell, the source rod removed and both the source rod and the tube through which it slides should be cleaned. Difficult operation will be caused by dirt or foreign particles falling into the source tube.

MAINTENANCE

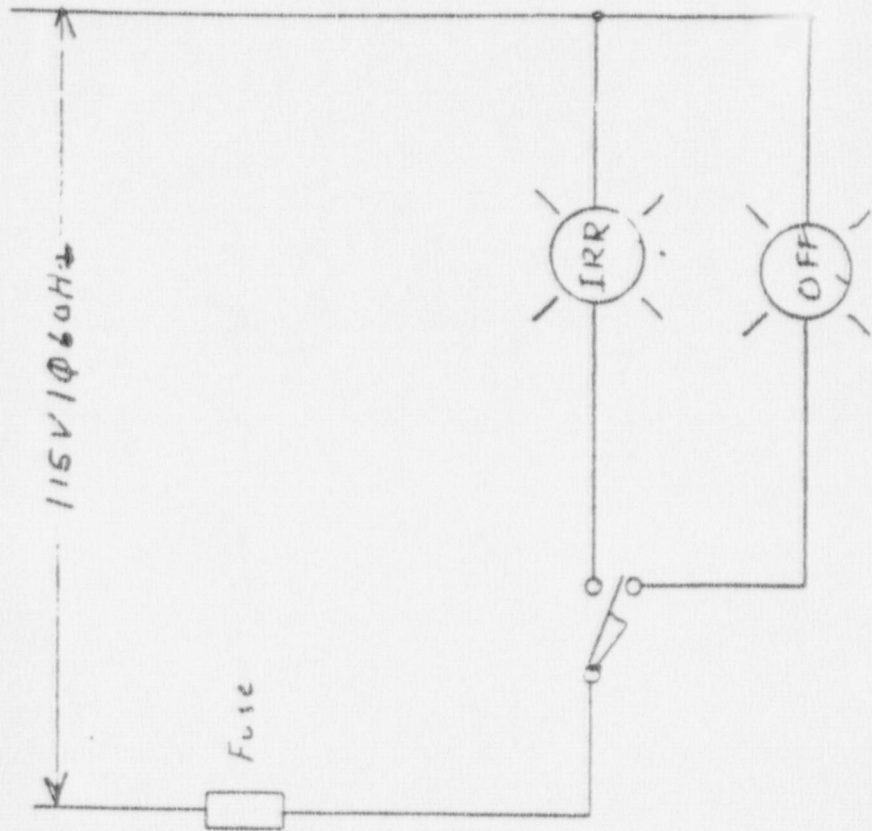
1. DO NOT lubricate the source rod at any time in any way. LUBRICATION OF ANY KIND WILL VOID ALL WARRANTY.
2. Operate the unit in a clean atmosphere. Do not permit dirt or other particles to fall in hole at top of unit. When not in operation, it is recommended that the unit be covered, i.e., by a plastic bag, etc.

INSTALLATION AND OPERATION FOR SLIP-ON ATTENUATORS

The attenuators on your unit are cumulative. To provide X-2 attenuation, use the X-2 attenuator. To provide X-4 attenuation, use the X-2 and the X-4 (mounted outboard the X-2). For X-10 attenuation, use the X-2 + X-4 + X-10 (mounted outboard on the X-4). For X-100 attenuation, use the X-2 + X-4 + X-10 + X-100 (mounted outboard on the X-10). All calibration values for attenuation were made using this set up.

X-2	: X-2
X-4	X-2 + X-4
X-10	X-2 + X-4 + X-10
X-100	X-2 + X-4 + X-10 + X-100

All calibration made with attenuators should be made at a source detector distance of one meter or greater.



J. L. SHEPHERD and Associates

SCALE:	APPROVED BY:		DRAWN BY:
DATE:			REVISED:
ELECTRICAL SCHEMATIC FOR SERIES			
DRAWING NUMBER			

JLSHEPHERD *and Associates*

740 Salem Street, Glendale, California 91203

• 213/245-0187

Irradiation & Calibration Equipment

• *Lead Shielding*

• *Nuclear Applications*

WARRANTY

THIS IS TO CERTIFY THAT THE UNIT MEETS ALL APPLICABLE D.O.T. SHIPPING REGULATIONS RELATED TO EXTERNAL RADIATION LEVELS FOR CONTAINERS FOR RADIOACTIVE MATERIALS.

FREE PARTS AND SERVICE WILL BE ALLOWED FOR THREE MONTHS FOLLOWING INSTALLATION WITH REPLACEMENT OF FAULTY COMPONENTS FOR AN ADDITIONAL NINE MONTHS.

INSTALLATION AND OPERATING MANUAL FOR THE MODEL 150 TRACK SYSTEM

S.N. _____

INSTALLATION

1. Remove all components from the packing crate.
2. Lay out track sections and base assemblies in accordance with Chart A, which is part of this manual.
3. Bolt track sections 1R and 1L to stand No. 1.
4. Attach the other end of these track sections to the base of the calibrator, bolting the angle brackets welded to the track sections to the holes provided on the base in front of the beam port.
5. Bolt track sections 2R and 2L to stand No. 2; then bolt the other ends of these sections to stand No. 1.
6. Assemble sections 3, 4, and 5 in accordance to "5" above.
7. Align the assembled track with a straight edge and adjust the leveling screws on each side of each base assembly so that the track is level.
8. Remove the drive pulley brackets and the blue table stops at the end of the track opposite the calibrator.
9. The rolling table is shipped complete with instrument calibration table and elevating stand. Slip this assembly over the end of the track opposite the calibrator, taking care that the wheels fit over the top of the Tee track and that the slotted guides fit over the horizontal section of the Tee. The end with the narrow border faces the calibrator.
10. Replace the table stops and chain drive pulley brackets on the end of the track.
11. The 1/4" bead chain, which drives the rolling table assembly, is shipped with one end attached to the bracket on the rolling table, enclosed in a bag. Remove the bag and engage the bead chain over the driving sprocket at the calibrator end of the track. Bring the loose end of the chain the length of the track over the idler wheels.

Continue over the idler wheel at the far end of the track and back to the bracket on the rolling table. There a threaded hole with screw is provided to attach the end piece of the chain.

12. Adjust the slotted idler wheel at the take-up end so that the chain is reasonable taut. The rolling table should now move easily back and forth by turning the handwheel attached to the drive sprocket. This is located to the side and slightly behind the calibrator.

Note: The knurled nut on the drive wheel assembly, which locks the rolling table at any position on the track, must be loosened before the handwheel will turn.

13. The table position-indicator tape is shipped attached to a mounting bracket. This bracket is bolted to the rear section of the Tee track which extends past the center line of the shield facing in the direction of the beam port.

The end of the tape is attached to the underside of the rolling table using screws provided.

14. Mount the mirror bracket to the rear of the instrument table. Use the hole provided, then attach the second bracket, with the mirror attached, to the first, using the clamp provided.

15. Mount the optical viewing stand on the tripod.

INSTALLATION IS NOW COMPLETE*

OPERATION

1. Place the instrument to be calibrated on the engraved instrument plate. The center (6") line designates the center of the table in both directions. Adjust the sliding stops on the plate as required. Adjust the mirror so that the instrument meter can be seen in the optical viewing stand behind the calibrator. Adjust the table elevation by turning the handle of the drive (rack and pinion) mounted on the rolling table. The center line of the detector should be in line with the centerline of the beam port.

Note: Normally, the friction of the elevating mechanism is sufficient to maintain the table height without locking it in place. However, if a sufficiently heavy instrument on the instrument table causes the table to slip, there is a locking nut directly below the table (on the lower part) of the rack assembly which may be tightened to secure the table at any elevation.

2. To adjust the source-detector location, loosen the knurled locking nut on the operating handle for the table drive. Drive the table to the desired source-detector distance. The distance from the source center line to the center of the table is indicated on the tape. The tape is located directly under the arrow on the pointer which is at the center line of the shield. To lock the rolling table in the desired location, tighten the knurled nut. If the track is mounted level, it will not be necessary to lock the table location, unless several instruments are to be calibrated in the same location.

3. Focusing of the telescope, which is part of the optical viewing stand, may be adjusted by turning the front lens section of the telescope.

TROLLEY POSITION CONTROL

Trolley positioning is controlled by the Minarik speed controllers mounted on the control panel and on the trolley. To operate the controllers, move the power switch to either the high or low range position.

The selector switch should be moved to the forward position to drive the trolley away from the calibrator, and to reverse position to drive the trolley toward the calibrator. Speed of motion is controlled by the large knob on the lower right hand part on the speed controlled panel with calibration from 0 to 100. For gross positioning, use high-range on the power switch and high rating on the speed control knob. For fine positioning, move the power switch to low position and the speed control knob to a low number. NOTE: The power light on the control box is illuminated whenever it is activated.

CAUTION: Limit switches at both ends of the track, and at an intermediate position near the calibrator, are incorporated which automatically stop trolley movement in these positions. When the limit of travel is reached in the trolley position closest to the calibrator, at which time the selector switch will be in the reverse position, move the selector switch to the forward position and momentarily press the manual release button on the control panel. This button over-rides the limit switches. If, upon reaching the end of travel in either direction, the selector switch is not reversed from its previous setting and the manual release button is pushed, the circuit breaker will open and must be reset.

After trolley is driven, in the forward selector switch position, to the limit of travel away from the calibrator, turn the selector switch to "reverse" and activate the manual release. Switch as above.

Each time the main power switch is turned on, the electronic counter must be reset. To do this, drive the trolley toward the calibrator until it reaches the limit switch and the drive is automatically turned off. At this point, reset the position indicator by pressing the red button (see below for further details). For absolute reproducibility of the drive system, speed selection should be at 50 when the table is driven to the index position.

The trolley has two indexed positions: against the fixed stops nearest the calibrator for use with the gamma calibrator, and against the swinging stops for use with the beta calibrator. The trolley must be driven firmly up against these stops for accurate indexing. A number reflecting the actual distance in millimeters between the source and instrument table centerlines (for each calibrator) is included as part of the track calibration data; dial the correct number into the electronic position indicator and push the reset button to make this number appear on the display. The display will count up or down, using this number as the reference point.

To achieve exact position and reproducibility, always drive the trolley slowly to the desired position with the selector switch in a forward position or in a forward direction.

A true or actual source centerline to table 00 distance vs. indicated distance is incorporated as part of this manual and should be used at all times.

All calibration data is given using real or actual, not indicated, distances.

A selector switch on the control panel controls trolley operation either local (control panel) or remote (in room).

Emergency stop switches are provided both on the trolley and on the control panel.

INSTALLATION & OPERATING MANUAL FOR MODEL 150 TRACK ASSEMBLY

The gear motor, shaft encoder, and drive sprocket for table drive are mounted on a single black steel structure.

Step 1. Bolt the black steel structure to the underside of the top plate of the base using flat head Allen bolts provided. This is on the left side facing the beam port. This must be done before the shield is mounted to the base. Before proceeding with track assembly, the shield must be mounted to the base using the four bolts provided.

Step 2. Proceed with the assembly of the Model 150 Track Assembly. Three track stands with adjustable feet are provided. Track mount stamped AJ is at the end of the track. Track mounts stamped HI and CB are next to the end and should be mounted with section CH facing the beam port. Track mounts stamped ED and FG are mounted closest to the Model 78 with side EF facing the Model 78. Mount the sections of the track on the track mounts with identical letters matching. At this point, the four Allen head capscrews, one each at each rail junction, should be bolted in place. NOTE: These screws hold the rail in proper alignment. Use washers provided. The end of the track next to the calibrator is mounted on the bracket attached to the base of the calibrator on the left side facing the beam port and on the bracket provided on the motor drive assembly placed on the right side facing the beam port. Remove the stop bracket at the end of the track (with rubber sheathing attached) and roll the instrument calibration table on to the track with the narrow margin outside of the scribed area facing the beam port. Replace the end bracket.

NOTE: The table is shipped with lifting system assembled. Thread the vertical camera mounting fixture to the bolt which extends thru the rear top of the table. Tighten. The horizontal camera mounting tube with pan-head attached is then slid through the mounting bracket mounted on the vertical tube attached to the top of the table. This bracket provides for both vertical adjustment and horizontal adjustment of the pan-head using Allen bolts and T-handle provided.

Step 3. Mount the two limit microswitches for the track assembly which are equipped with brackets through the holes provided in the right hand rails facing the beam port. Cable hold-down clamps are also provided.

Step 4. Remove the 1/4" roller chain from the package and engage it over the sprocket on the drive assembly, as well as over the idler sprocket at the end of the track. It is then attached to the bracket on the side of the rolling table, using the master links which are shipped connected to the ends of the chain.

NOTE: It may be necessary to remove the rear idler sprocket assembly from the track and replace it after the chain is attached to the rolling table. The rear idler sprocket bracket is slotted to act as a tensioner for the roller chain. (The roller chain also slips over teflon guides mounted on the sides of the track.) Next, plug in the 6-pin amphenol on the cable provided to the shaft encoder. The other end of the cable has a 4-pin amphenol connector on the back of the control panel. Mount the chrome 4-pin connector attached to the motor drive to the mating connector on the back of the control panel.

OPERATION OF THE MODEL 150 TRACK SYSTEM

Place instrument to be calibrated on the engraved table. Adjust height of table so that the centerline of detector is centerline of beam port.

Table height is adjusted as follows. Loosen the black (approximately 1 1/2" diameter) locking nut underneath the rolling table. To raise, turn the crank handle extending past the back of the rolling tube in a clockwise direction. To lower the table, press the short chromed release lever (catch) located directly on top of the rolling table, and turn the crank handle counterclockwise. Caution: Do not attempt to lower the table without releasing the chrome catch on the vertical drive system, for the table will be permanently damaged.

After desired height has been selected, retighten the locking nut underneath the rolling table to provide for rigidity of the elevating system.

At this point, if more than one instrument at the time has to be calibrated, adjust the stops provided for the table top for automatic repositioning of the instruments. Note: the vertical centerline of detector should be on the 00 mark as engraved on the table.

INSTRUMENT TABLE POSITION CONTROL

Instrument table positioning is controlled by the Minarik speed control mounted on the control panel. To operate the control, move the power switch to either the high or low range position.

The selector switch should be moved to the forward position to drive the table away from the calibrator, and to reverse position to drive the table toward the calibrator. Speed of motion is controlled by the large knob on the lower right hand part on the speed control panel with calibration from 0 to 100. For gross positioning, use high-range on the position switch and high rating on the speed control switch. For fine positioning, move the range switch to low position and the speed control switch to a low number. NOTE: The power light on the control box is illuminated whenever it is activated.

CAUTION: Limit switches at both ends of the table drive are incorporated which automatically stop table movement in these positions. When the limit of travel is reached in the table position closes to the calibrator, at which time the control switch will be in the reverse position, switch the control switch to the forward position and momentarily press the manual release button on the control panel. This button over-rides the limit switches. If for any reason the manual release button is pressed when driving the table to the calibrator while the control switch is still in the reverse position, the 1.5 amp fuse at the rear of the control panel in line with the speed control will be blown.

CAUTION: Do not employ a fuse greater than 1.5 amps in this position or the motor control circuit will be burned out. In as much as fuses may be blown by failing to reverse the directional switch when the end of the travel has been reached, we have provided a supply of 1.5 amp 115volt fuses. Always keep a supply of spare fuses of this amperage readily available. Do not use SloBlo fuses.

After table is driven in the forward limit switch position at the limit of travel away from the calibrator, turn the control switch to the reverse and activate the manual release. Switch as above. All of the above data related to fuses also pertains to forward position limit switches.

Each time the main power switch is turned on, the electronic counter must be zero. To do this, drive the table toward the calibrator until it reaches the limit switch and the drive is automatically turned off. At this point, zero the position indicator by pressing the red button. For absolute reproducibility of the drive system, speed selection should be at 50 when the table is driven to the 0 position.

To achieve exact position and reproducibility, always drive the table to the desired position with the control switch in a forward position or in a forward direction. Back lash in the drive system may result in an error of several millimeters if the table is driven to its final position in the reverse direction.

A true or actual source centerline to table 00 distance vs. indicated distance is incorporated as part of this manual and should be used at all times.

All calibration data is given using real or actual, not indicated, distances.

OPERATION OF THE INSTRUMENT TABLE

Place instrument to be calibrated on the engraved instrument table. Adjust height of table so that the centerline of detector is at centerline of beam port.

Table height is adjusted as follows. Loosen the black (approximately 1-1/2" diameter) locking nut underneath the trolley. To raise, turn the crank handle extending past the back of the rolling table in a clockwise direction. To lower the table, press the short chromed release lever (catch) located directly on top of the rolling table, and turn the crank handle counterclockwise. Caution: Do no attempt to lower the table without releasing the chrome catch on the vertical drive system, or the table will be permanently damaged.

After desired height has been selected, retighten the locking nut underneath the rolling table to provide for rigidity of the elevating system.

At this point, if more than one instrument at the time has to be calibrated, adjust the stops provided for the table top for automatic repositioning of the instruments. Note: The vertical centerline of detector should be on the 00 mark as engraved on the table.

INSTALLATION & OPERATING MANUAL FOR MODEL 150R TRACK SYSTEM

The gear motor, shaft encoder, and drive assembly for trolley drive are mounted on a single black steel structure.

Step 1. Bolt the black steel structure to the underside of the top plate of the base using flat head Allen bolts provided. This is on the right side looking into the beam port. This must be done before the shield is mounted to the base. Before proceeding with track assembly, the shield must be mounted to the base using the four bolts provided.

Step 2. Proceed with the assembly of the Model 150R Track System. Five track stands (adjustable heightwise by the use of spacer washers, included) are provided. For reference, the "left" and "right" sides of the track are determined by standing behind the calibrator and looking in the direction of the radiation beam; the "left" side is on your left, etc. The five track stands are numbered 1 through 5, with #1 being closest to the calibrator, and #5 being at the far end of the track. The track rails are bolted to the track stands with 1/4"-20 x 1/2" hex bolts. Track rails and stands are identified with letter/number combinations stamped on them; match these combinations to assemble the track system. It is helpful to lay out the rails and stands, on the floor, in their approximate locations prior to assembly.

The ends of the rails closest to the calibrator are attached to the calibrator base, under the base's plate. For best results, assemble the track in the following sequence:

- (1) Attach rail end "1R" to track stand at location "1R".
- (2) Attach rail end "OR" under base plate at "OR".
- (3) Attach rail end "OL" under base plate at "OL".
- (4) Attach rail end "1L" to track stand at location "1L".

(5) Use a level to determine proper alignment of track rails, both longitudinally and side-to-side; adjust levelling feet under each side of the track stand crossbar to correct discrepancies. The track rails should be level in both directions.

(6) Continue to assemble the track in a similar manner, working your way out from the calibrator. Attach one end of a rail to the next stand, attach the other end to the end of the assembled track, and then do the same with the rail on the other side. Remember to level the track rails every time. You may have to install temporary spacers (1/2") under the track stand crossbars in order to get the attachment holes in rails and stands to line up. It is best not to tighten the bolts holding the track system together until the whole unit is assembled.

Step 3. Alignment of the track over its total length can now be accomplished. First, make sure that the track section nearest to the calibrator is square to the beam port. Effect correction, if necessary, by moving the whole track to one side or another (in small increments - do not bend rails or stands too much). Then, check alignment of the rest of the track, section by section (moving away from the calibrator), by using a string stretched from the ends of the track rails that are attached to the calibrator base, to the ends of the rails of the section being checked. Be sure to check both sides of the track; when straight, the string should lie flat against the outside of the rails on either side of the track.

Step 4. If it is desired to bolt the track stands to the floor, this should be done at this time. Mark the places on the floor, under the holes in the feet, where the bolts will go. The track will most probably need to be disassembled, one or two sections at a time, in order to drill into the floor. Bolts for securing the track stands to the floor (thread size = 1/4-20) are included. The track can be re-assembled after the anchors have been sunk into the floor.

Step 5. Remove the fixed stops from the end of the track farthest from the calibrator. Also remove the chain idler assembly from the drive side of the track, at this end. Roll the trolley (with instrument table installed) onto the ends of the track rails; the edge of the trolley plate that the instrument table overhangs is the edge which is closest to the calibrator. Replace the fixed stops and chain idler assembly. Thread the six threaded support rods (included) into the instrument table as required.

Step 6. Mount the two limit switches on either end of the track, on the drive side rails. Threaded holes for the limit switch brackets are located under the fixed stops; the brackets attach to the underside of the horizontal section of the rails. Look for the letter or number stamped on the brackets, and match them to the corresponding figure on the rails; each limit switch tang should be positioned so that it meets the edge of the trolley as

it approaches the fixed stops. Route the electrical cable for the limit switches around the fixed stops, away from the trolley. Cable hold-down clamps, located at the midpoint of each drive side track rail, are provided for securing the electrical cable to the top horizontal surface of the track rails.

Step 7. Remove the #25 roller chain from its package. Lay clean newspaper or heavy paper on the ground alongside the drive side of the track to keep chain clean. Find an end of the chain and attach it to the bracket on the drive side of the trolley, using the hole nearest to the calibrator. A connecting link is provided on each end of the chain for this purpose; one pin of the link goes in the bracket hole, and the other goes through the chain. Take the other end of the chain and route it around the sprocket which is located in the cage, on the drive assembly steel structure. Do not twist the chain. Make sure that the chain is riding in the nylon idlers located on the outside of the rails. Take the loose end of the chain and run it down the length of the track, laying it in the lower set of nylon idlers. Wrap the chain around the idler sprocket at the far end of the track and bring the end to the trolley, where it attaches to the bracket (as before). Slack in the chain can be taken up by moving the chain idler assembly, at the far end of the track, in the direction away from the calibrator. The chain idler assembly has slots in it for this purpose; tighten the bolts which hold it down after positioning it properly.

Step 8. Swinging stops have been provided on this track system to allow positive indexing of the trolley when the beta calibrator is in use. These stops will also prevent the instrument table from hitting the beta calibrator. These stops are attached to the pair of track rails nearest the calibrator; the stop on the drive side also incorporates a limit switch to stop trolley movement. The stops may or may not come installed on the rails; if not, first attach them with the screws and spacers provided. The stops and rails are stamped with identifying letters or numbers; match these to the characters stamped on the rails.

The swinging stops have two positions: up and down. They are secured in the "up" position with brass thumb screws (supplied); each screw passes through the hole in the track rail and threads into the stop. In the "down" position, the stops swing out of the way of the trolley; thread the thumb screws into the stops to prevent their loss.

NOTE: When moving the swinging stops to the "up" position, be sure to move the trolley far enough away from the calibrator so that the stops don't hit the bottom of the trolley.

Step 9. Attach closed circuit television equipment to trolley. Use the 120 VAC power strip, provided on trolley, for plugging in this equipment. Route coaxial cables, trolley power cable, etc., to overhead track system.

Step 10. Install trolley-mounted speed controller and counter on trolley. The speed controller and counter are assembled onto a shelf, which bolts onto the side of the trolley opposite the drive system. Screws for this purpose are included. Plug the end of the speed controller electrical cable into the mating socket on the trolley; do the same for the counter.

Step 11. Connect the electrical cables from the shaft encoder and drive motor (which are located on the drive assembly structure) to the main control panel. The wires are coded for easy reference. At this time, connect the wires from the overhead track system to their respective locations on the main control panel. A selector switch on the control panel provides for control either at the control panel or trolley: The pushbutton "emergency stop" switch on the trolley cuts all power to the unit at all times.

JLS SHEPHERD *and Associates*

740 Salem Street, Glendale, California 91203

• 213/245-0187

Irradiation & Calibration Equipment

• Lead Shielding

• Nuclear Applications

OPERATING MANUAL
FOR
MODEL 81 IRRADIATORS

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81 BEAM IRRADIATOR

S.N. _____

NOTICE: IF AT ANY TIME THIS IRRADIATOR MALFUNCTIONS, REMOVE THE UNIT FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD AND ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

RADIATION SAFETY

The Model 81 Irradiator emits an intense beam of radiation through the area subtended by the beam port whenever any source is in the "Expose" position. A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. The user should set up exclusion lines for personnel using this irradiator as well as limited room access. This information is ordinarily included as part of the facility operation rules and is required as part of the user's license to possess the irradiator.

At intervals not exceeding six months, leak tests should be made on the irradiator by taking wipes at the nearest accessible surface to the source when it is in the "OFF" position. This surface should be the place where the source operating rod extends through the lead shielding. These wipes should be measured on an instrument capable of measuring 0.005 uc of Cesium-137. Use of irradiator should be stopped if contamination is detected and the manufacturer should be notified.

NOTE: The 0.005 uc level is that generally prescribed by regulatory authorities; individual institutions may require more stringent standards.

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81
Page 2.

INSTALLATION PROCEDURES

The Model 81 Beam Irradiator is shipped in four parts: Base, Source Shield, Pneumatic Drive Assembly, Control Panel and Cover.

Instructions for removing the irradiator from the 29WC-5 Overpack are as follows:

1. Using a 13/16" or 3/4" deep well socket (as required); remove the nuts from the sixteen each 1/2" rods located approximately 5" from outer rim of the top of the overpack.
2. Sling the top chine of the overpack and lift the top section, using a vertical lift so as not to bend the rods. The top section is approximately 12" high.
3. Remove any wood shoring from the top and sides of the units in the overpack.
4. Attach a cable or chain to the eye-bolts provided and lift the unit vertically from the overpack.
5. Remove the metal or wood round attached to bottom of unit.

Instructions for Installation of unit are as follows:

1. Place shield in desired location with the beam port facing properly. Bolt to base provided.
2. Remove the shipping plate from the top of the irradiator.
3. The operating tower which contains the pneumatic assembly is shipped with the outside cover or shroud attached. Remove the shroud from the tower assembly. NOTE: To remove the shroud use the following procedure; (a) Remove the piece of copper tubing with compression fittings that extend from a fitting on the side of the tower base to the tee outlet from the oiler-filter-regulator, (b) Open the hinged cover and disconnect the Jones Plug inside the cover, (c) Unbolt the cover from the tower base and remove, and (d) Remove the padlock and locking bolt which holds the cylinder in the extended position. These may be replaced later to lock the source assembly in the "OFF position.

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81
Page 3.

INSTALLATION PROCEDURES CONTINUED

4. Place pneumatic cylinder assembly on top of the irradiator. Locate over the bolt pattern provided, noting the orientation of the tower with the arrow stamped on top of the base plate pointing toward the beam port. Secure the tower to the shield with lock washers and nuts provided.
5. Block the beam port with 4' minimum lead.
6. From a position at the rear of the irradiator, opposite the beam port, raise the source rod which is centerline of the irradiator slightly and engage the threaded rod into the tapped hole at the bottom of the fixture which is mounted to the cylinder rod. Thread the source operating rod into the fixture until it stops. It may be necessary to use a vise grip on the upper section of the source rod to thread all the way into the fixture. Next, drive the sel-lok pin into the fixture. With the source rod threaded fully into the fixture and the lock nut on the cylinder clevis, (set as it was at the factory, against the end of the wrench, flat on the end of the cylinder) the source is centered in the beam port. For information on source adjustment, see the adjustment section of this manual.
7. Mount the shroud over the cover assembly, re-attaching the Jones connector inside the tower and re-attaching the copper tubing from the oiler-filter-regulator to the inlet port on the side of the tower.
8. Next, connect an air supply rated at 60 psi or greater, to the inlet of the oiler-filter-regulator. NOTE: The unit requires a setting of 40 lbs. on the regulator built into the unit to function properly. This is factory adjusted, and may be adjusted slightly in the field. See adjustment section. Next, fill the oiler section of the oiler-filter-regulator with SAE 10 weight non-detergent oil as indicated in the instructions for the oiler-filter-regulator contained as part of this manual.
9. Connect the amphenol connector from the control panel to the connector mounted on the tower.
10. Plug the cord from the control panel into a 115 volt single phase electrical outlet rated at 15 amps.

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81
Page 4.

INSTALLATION PROCEDURES - Control Panel

1. Plug in external radiation light to plug provided.
2. Plug the door interlock and any other interlock inside room to interlock connectors.

NOTE: Both external interlock circuits and the interlock switch on the irradiator must be closed or:

1. The source will not raise; or
2. If in the raised position when the locks are closed, the source will immediately return to the "SAFE" position.

OPERATION

1. Plug in the control box to a 115v 60 cycle AC outlet rated at 20 amps; connect the cable from the control panel to the irradiator. The unit is now ready for operation.
2. Turn the key switch to the "ON" position. A panel light will indicate that the power is on.
3. Place the mode selector switch to "MANUAL" or "PRESET" time.
4. To preset time on the digital timer, press buttons above and below digits on the right side of the timer.
5. To expose the source, press the "IRRADIATE" switch on the control panel. This will initiate a 10 second time delay during which the warning buzzer on the irradiator will sound. At the termination of the 10 second interval, the source will be exposed. The interlock switch on the irradiator must be "ON" or the source will not raise. The position lights show the position of the source at all times. The "ON" light is illuminated whenever the source is not in the fully shielded position.
6. The source exposed may be returned to the "OFF" position by any of the following methods:
 - a. completion of the preset exposure;
 - b. pressing the "off" button which overrides the preset timer; or
 - c. activation of any interlocks, i.e. door interlock, plugged into the back of the control panel, or the interlock switch on the irradiator.

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81
Page 5.

NOTE: After the completion of any exposure, it is necessary to press the "reset" button before another exposure is initiated. If this is not done, the source cannot be raised. Pressing the "reset" button will automatically reset the time previously selected. In operation, the timer starts at 000.000 and counts up to the preset time after the exposure is completed, showing at all times the time expired on the preset exposure.

ADJUSTMENTS

1. Source travel speed may be adjusted by adjusting the pressure delivered to the cylinder.
2. Source travel should be smooth and rapid, but should not slam source rod in either direction. If source rod travel is jerky or hesitant, the pneumatic assembly is misaligned and should be re-adjusted, taking care that the bottom of the pneumatic assembly is clean and that all hold bolts are evenly adjusted. If action is not smooth and regular after this adjustment, the factor should be called for further instructions.
3. An assembly drawing, a pneumatic schematic and an electrical schematic drawing are a part of this manual.

GENERAL INFORMATION

1. The irradiator incorporates a 400Ci Cs-137 source. Operation is by a double acting pneumatic cylinder actuated by a four-way solenoid valve, normally open on one side, normally closed on the other.
2. Whenever air pressure is provided to the system, regardless of whether or not the power is on, the cylinder is pressurized to hold the sources in the "off" position.
3. In addition, the source is held in the "off" position by four constant pressure negator springs attached to the upper end of the cylinder rod.

SAFETY FEATURES

1. The shield design provides for full shielding in all directions at all times except out the beam port when the source is in the "on" position.
2. The spring return assembly on the pneumatic source operating cylinder provides failsafe operation in that the source automatically returns to the "off" position in case of air or power failure. In addition, the normally closed solenoid valve provides pressure to hold the source in the "off"

INSTALLATION & OPERATION INSTRUCTIONS FOR MODEL 81

Page 6.

position whenever air pressure is supplied to the system and the "on" switch is not activated.

3. The source rod never touches the bottom of the table in which it travels (clearance is approximately 1/2") eliminating the possibility of damage to the source by striking the end of the source tube.
4. Two interlock connectors are provided on the control panel. When connected to a door or other interlock switches, the source automatically returns to the "off" position when the door is opened or the other switch is opened.
5. The "source on" light is activated as soon as the source leaves the completely "safe" position. The upper microswitch serves only to activate the preset timer.
6. An interlock switch is built into the irradiator. When this is in the "off" position, the source cannot be raised. Personnel entering the room to make set-ups, etc., should turn this switch to the "off" position and leave it there until they are leaving the room to make an irradiation. When leaving, they must turn this switch "on" or the source cannot be raised.

EMERGENCY PROCEDURES

If, at any time, the source fails to return to the "OFF" position as shown by the source position indicating light on the control panel at the end of the preset of manual exposure or after operation of an interlock, the following procedures are to be followed:

1. Enter the irradiation room. Approach the irradiator from the back, opposite the beam port. Unlatch the cylinder cover and move source rod downward until source is shielded (in the "OFF" position). A high-range survey meter should be carried during this procedure.
2. TAKE THE IRRADIATOR OUT OF OPERATION IMMEDIATELY AND CALL THE FACTORY FOR AN AUTHORIZED REPRESENTATIVE TO EFFECT REPAIRS.

ATTACHMENT 3

WRSD CALIBRATION FACILITY

ATTACHMENT 4

REVISED WRSD RADIATION PROTECTION MANUAL